DEVELOPING A MATHEMATICS EBOOK BASED FLASH FOR CLASS VIII LINEAR AND EQUATION SYSTEM OF TWO VARIABLES MATERIAL

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ABSTRACT

Flash-based math ebook development for student of 8th grade in a system of linear equation in two variables material be set in learning of the lack of development of a variety of electronic learning media of mathematics as well as lack of utilization of information and communication technology for learning in SMP Muhammadiyah Banguntapan and SMP Muhammadiyah Boarding School Pleret. This study aims to develop a flash-based math ebook for a student of 8th grade in a system of linear equation in two variables material and know the properness of the ebook. The method used in this research is Research and Development (R & D) by using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). The subject of this study are two media experts, two math experts, 38 students of 8th grade of SMP Muhammadiyah Banguntapan, 12 students of 8th grade of Al-Qadar Banguntapan tutoring class and 31 students of 8th grade SMP Muhammadiyah Boarding School Pleret. This research used the non-test technique. While the research instrument used was questionnaires assessment for media experts, material experts, and the response of students who had evaluated before, through instrument test, validity test, and form. The technique of data analysis is qualitative and quantitative analysis to describe the ideas and analyzes the assessment result of material experts, media experts, and responses of a student to the book. Result of the study and development show that math ebook development include in good category based on questionnaire Assesment by material expert with average score 62,00 from a maximum score of ideal 75. Results of questionnaire assessment by media expert include in good category based on questionnaire Assesment by material expert with average score 83,50 from maximum score of ideal 100. Whereas results of questionnaire assessment by student responses on product trials in a small class and large class include in a good category with an average score of 33.62 from a maximum score of ideal 40. The result of the study shows that flash-based math ebook development for the student of 8th grade in the system of linear equation in two variables material proper to used in the learning process.

Keywords: Math Ebook, Flash, Systems of Linear Equations in Two Variables

INTRODUCTION

From time to time humans experience development marked by changes that are progressive. Humans can achieve these changes after learning activities. In the process of education, learning is the main activity of students. The role of teachers as educators in learning activities in schools related to student learning activities is relatively high. But there are times when a teacher cannot attend teaching and learning activities, therefore students learn without being guided by the teacher concerned. To anticipate everything that happens during the teaching and learning process, a teacher designs a lesson plan (RPP) and prepares a learning medium before starting the teaching and learning activities. The teacher can create a learning program by utilizing media and learning resources to create a conducive, varied and enjoyable learning atmosphere so that students as students can participate in learning well.

Based on an interview with Mrs. Zunita Rahmaniawati on Saturday, August 22, 2015, at Muhammadiyah Middle School in Banguntapan, mathematics as a science that studies abstract objects, especially in class VIII material, often creates difficulties for students in understanding the material. In addition, most students when outside of teaching and learning activities do not repeat the lessons that have been given in class, this triggers the low learning outcomes when the test is held. The average repeat value of the system of linear equations for two variables of class VIII A and VIII B of Muhammadiyah Junior High School in Banguntapan is still below the KKM, which is 52.2 with KKM 72.

Muhammadiyah Banguntapan Middle School has two labs. computers with fairly complete equipment and an internet connection that can be accessed via a wifi network. But this school very rarely organizes electronic mathematics learning. This is due to the limited electronic mathematics learning media available in schools. The teacher used electronic media when the 2013 curriculum was implemented but has never made electronic media themselves. The use of electronic media was only applied a few moments during the beginning of the 2014-2015 school year, while the rest of the students learned to use textbooks that were lent while at school. However, not all students can borrow textbooks to study at home because of the limited availability of textbooks. The number of books available is less than 40% of the number of students. The existence of a learning media that can reduce the abstractness of objects in mathematics and increase students' willingness to learn and practice math problems is expected to help students in understanding the mathematical material being studied.

The same thing was also justified by Mrs. Siti Muslihah who teaches mathematics in SMP NI Banguntapan, during an interview on August 26, 2015 she mentioned that algebraic operating material, quadratic equations, and linear equation systems are two variables longer to deliver when compared to the material in building space like calculating the surface area and volume of a cube. Whereas at the Pleret Muhammadiyah Boarding School Middle School, the results of an interview with Ustadzah Yanu Milani on August 14, 2015, stated that most students at the Pleret Muhammadiyah Boarding School Middle School who have personal laptops are accustomed to using their laptops to study outside the KBM. But its use for learning mathematics is still very rare.

The development of information and communication technology that encourages the development of electronics enables the creation of non-paper learning media in the form of electronic books that are easy to carry, store, and read anytime and anywhere. Text writing on books can be stored in electronic form, even the text file format in the ebook can be equipped with sound, animation, and does not rule out the possibility of being connected to the internet. Ebooks can be stored and opened through electronic devices such as laptops, computers, tablet PCs or smartphones. Macromedia flash 8 software can be used to design objects that combine text, sound, graphics, animation, and video, including learning media that are interesting, more interactive, and reduce the abstractness of objects in mathematics.

The lack of development of variations in the electronic media of mathematics learning as well as the lack of use of information and communication technology for learning in SMP Muhammadiyah Banguntapan and SMP Muhammadiyah Boarding School Pleret become several factors that encourage researchers to hold "Development of a flash-based mathematical ebook for students of class VIII material systems of linear equations of two variables ".

The objectives to be achieved in this study are as follows: Develop a flash-based ebook learning media for class VIII material systems of two-variable linear equations. From time to time humans experience development marked by changes that are progressive. Humans can achieve these changes after learning activities. In the process of education, learning is the main activity of students. The role of teachers as educators in learning activities in schools related to student learning activities is relatively high. But there are times when a teacher cannot attend teaching and learning activities, therefore students learn without being guided by the teacher concerned. To anticipate everything that happens during the teaching and learning process, a teacher designs a lesson plan (RPP) and prepares a learning medium before starting the teaching and learning activities. The teacher can create a learning program by utilizing media and learning resources to create a conducive, varied and enjoyable learning atmosphere so that students as students can participate in learning well.

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The objectives to be achieved in this study are as follows:

1. Develop a flash-based ebook learning media for class VIII material systems of two-variable linear equations.
2. Knowing the feasibility of a flash-based math ebook for students of class VIII material systems of two-variable linear equations.

Various opinions are present in defining the meaning of learning and learning, each opinion has different points of view in defining learning and learning, this is because the various opinions arise from the knowledge and experience of each expert who argues.

Slameto (2010: 2) argues, "Learning is a business process carried out by someone to obtain a new change in behavior as a whole, as a result of his own experience in interactions with his environment." Meanwhile, according to Reber in Sugihartono, et al. (2007: 74) that "Learning as a process of gaining knowledge and learning as a change to relatively lasting ability to act as a result of strengthened training."

From the opinions described above, it can be concluded that learning is an activity carried out consciously to achieve a relatively permanent change in behavior towards a better direction. While the definition of learning Suherman, Erman, et al. (2003: 8) argues: "Learning is a process of functional communication between students and teachers and students and students, in the context of changing attitudes and mindsets that will become a habit for students concerned". Based on the Law of the Republic of Indonesia Number 20 of 2003 concerning the national education system Article 1 Paragraph 20,

"Learning is the process of interaction of students with educators and learning resources in a learning environment. From the opinions above it can be concluded that learning is an interaction between students and educators and various components making up learning resources in order to achieve the expected learning goals.

Following are some definitions of mathematics in Suherman, Erman et. al. (2003: 16-17):

1. James and James stated that mathematics is the science of logic about shapes, arrangements, quantities, and concepts that are interconnected with each other which is divided into three fields namely algebra, analysis and geometry.
2. Johnson and Rising, which states that mathematics is a pattern of thinking, organizing patterns, logical proof, mathematics is a language that uses terms that are defined carefully, clearly, and accurately, its representation with symbols and solid, more in the form of symbolic language about ideas than regarding sound.
3. Reys argues that mathematics is a study of patterns and relationships, a path or mindset, an art, a language, and a tool.
4. Kline believes that mathematics is not a solitary knowledge that can be perfect because of itself, but the existence of mathematics is mainly to help humans in understanding and mastering social, economic, and natural problems.

From the opinions above it can be concluded that mathematics is the science of logical thoughts presented through the language of symbols to help humans in understanding and mastering the problems of daily life. According to Yamin, Martinis (2007: 176) states that media is a plural word from the medium derived from the Latin word which has an intermediate meaning. By definition, the media is a device that can channel information from sources to recipients of information. While the AECT (Association of Education and Communication Technology, 1977) in Arsyad, Azhar (2014: 3) sets limits on the media, that media as all forms and a channel used to convey messages or information.

In the learning process, learning media get a more specific definition from Briggs in Yamin, Martinis (2007: 177) expresses his opinion about the definition of media more specifically as physical means to convey learning content/material." Arsyad, Azhar (2014: 7-8) stated that: Learning media that are seen as all forms of physical communication equipment in the form of hardware and software are a small part of learning technology that must be created (designed and developed), used, and managed (evaluated) for learning needs with a view to achieving effectiveness and efficiency in the learning process. From the opinions above it can be defined that learning media are all things that can be used to convey learning material.

According to the National Center for Competency-Based Training in Prastowo, Andi (2011: 16) argues that "Teaching materials are all forms of material used to assist teachers or instructors in carrying out learning in class. The intended material can be written or unwritten material.

According to Pannen in Prastowo, Andi (2011: 17) revealed that teaching materials are materials or subject matter that are arranged systematically, which are used by teachers and students in the learning process. Prastowo, Andi (2011: 17) also argues that teaching materials are all materials (both information, tools, and texts) that are arranged systematically, which presents a complete figure of competencies that will be mastered by students and used in the learning process with the aim planning and studying learning implementation. For example, textbooks, modules, handouts, worksheets, models or models, audio teaching materials, interactive teaching materials, and so on. From the opinions, it can be defined that teaching materials are all forms of materials that are prepared for use in learning.

Seamolec (2014: 1) defines the ebook as follows digital books or electronic books, abbreviated as e-books, or ebooks, are digital forms of printed books. Printed books generally consist of a stack of bound paper containing text or text and / or pictures, then electronic books contain digital information that can contain text, images, audio, video, which can be read on a computer, laptop, tablet or smartphone.

While Firman Almadani through his personal website (Firman Almadani: 2014) argues that ebook stands for Electronic Book or electronic book. E-book is nothing but a form of book that can be opened electronically through a computer. This e-book is in the form of files with various formats, some

are in the form of pdf (portable document format) that can be opened with the Acrobat Reader program or the like. There is also a form of Html format, which can be opened by browsing or internet explorer offline. There is also an exe format.

From the opinions, it can be concluded that the ebook is a digital form of non-paper book that can be opened or read using a digital device such as a computer. So that the ebook that is developed is feasible to use, of course, it must follow several procedures for developing instructional materials that have been determined. According to the Ministry of National Education (2008: 8), a teaching material at least includes, among others:

a. Study Instructions
b. Competencies to be achieved
c. Content or content of learning material
d. Supporting Information
e. Practice
f. Work instructions
g. Evaluation
h. Response or feedback to the evaluation results

Furthermore, to provide criteria in assessing the feasibility as well as the evaluation and revision of the developed ebook, it can consider the following components:

a. The component of content eligibility includes, among others:
    1) Compliance with SK, KD
    2) Conformity with the development of children
    3) Conformity with the needs of teaching materials
    4) The truth of the substance of learning material
    5) Benefits for insight enhancers
    6) Conformity with moral values, and social values
    7) Language components include:
        a) Readability
        b) Clarity of information
        c) Compliance with good and correct Indonesian language rules
        d) Effective and efficient use of language (clear and concise)
    8) Presentation components include:
        a) Clarity of objectives (indicators) to be achieved
        b) Order of presentation
        c) Providing motivation, attractiveness
        d) Interaction (giving stimulus and respond)
        e) Completeness of information
    9) Components of the graphic include:
        a) Use of fonts; type and size
        b) Layout or layout
        c) Illustrations, drawings, photos
        d) Display design

    Ministry of National Education (2008: 28)

The components above can be developed as a grid in making an instrument format that is shared and filled out by related parties such as material experts, media experts, and students as users of ebooks that are developed. Computer-based learning is learning that uses computers as a tool. Through this learning, instructional media is displayed using a computer device so that teaching and learning activities become more interesting and challenging for students.

According to Hick & Hyde in Wena, Made (2014: 203) computer-based learning is: "A teaching process directly involves a computer in the presentation of instructional materials in an

interactive mode to provide and control the individualized learning environment for each individual student."

In this definition, with learning using computers students will interact and deal directly with computers individually so that what is experienced by a student will be different from what is experienced by other students.

According to Wena, Made (2014: 204), computer-based learning has the following advantages:

1) Give students the opportunity to solve problems individually.
2) It provides an interesting presentation with animation.
3) It provides a choice of various and varied learning contents.
4) Able to arouse student motivation in learning.
5) Able to activate and stimulate teaching methods properly.
6) Increase the development of students' understanding of the material presented.
7) Stimulate student learning with enthusiasm, the material presented is easily understood by students.
8) Students get concrete experiences, students' retention (memory attachment) increases.
9) Give feedback directly.
10) Students can determine their own pace of learning.
11) Students can do self-evaluation.

In terms of methods, Sugiyono (2010: 6) argues that "In terms of research methods can be divided into survey research, expo facto, experiments, naturalistic, policy research, evaluation research, action research, history, Research and Development (R&D)."As for research and development, Borg and Gall in Sugiyono (2010: 9) state that: "Research and development (R&D), is a research method used to develop or validate products used in education. and learning. From the opinion, development research can be interpreted as a research method to produce better learning products.

The type of research used is research and development with the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). "Research and Development is a research method used to produce certain products, and test the effectiveness of these products." (Sugiyono, 2010: 407). "Implementation of the ADDIE learning system design model which is carried out systematically and systemically is expected to help someone program designer, teacher, and instructor in creating effective, efficient, and attractive learning programs." (Personal, Benny A., 2009: 137). This research is focused on developing a flash-based mathematical ebook for class VIII of a two-variable linear equation system material.

The steps of this research study:

1. Analysis (analysis), namely the analysis of student characteristics through interviews with mathematics teachers at Muhammadiyah Middle School in Banguntapan and Muhammadiyah Middle School Boarding School, analysis of learning media needs through observations in computer labs and school libraries, and analysis of the mathematics curriculum at VIII Middle School, which is about competency standards and basic competencies in the material system of two-variable linear equations.
2. Design (Design), which is designing a flash-based mathematical ebook layout design for class VIII material systems of two-variable linear equations. Broadly speaking, the contents of the ebook itself consists of three parts, namely introduction, content, and closing.
3. Development (development), which is developing a flash-based mathematical ebook, starting from collecting references, making ebooks using Macromedia Flash 8, to uploading to the internet and closing ebook files into a Compact Disc (CD).
4. Implementation (implementation), the process of testing the feasibility of the ebook being developed. This stage begins with the validation process of material experts and media experts then proceed with the trial of the ebook to students, then the students are given a questionnaire to provide responses to the ebook that has been used. Furthermore, the data generated is used to evaluate and revise the ebook.

5. Evaluation (evaluation)

The fifth step of the ADDIE learning system design model is evaluation. "Evaluation can be defined as a process carried out to provide value to learning programs." (Personal, Benny A., 2009: 133). There are three aspects of assessment given in the evaluation process, namely: material aspects, media aspects, and aspects of student responses to the ebook. The assessment is used as a reference in determining the feasibility of the developed ebook.

This study uses a non-test technique. While the research instruments used a questionnaire. The data analysis technique used in the evaluation of this study is to analyze each questionnaire, both questionnaires for material experts, media experts and questionnaires for students. Data obtained from filling out the questionnaire is qualitative data which is then converted into quantitative data. All data collected in Sukarjo (2006: 55) is averaged using the formula:

$$\bar{X} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Information :

$\bar{X}$: average score

$\sum_{i=1}^{n} x_i$: total score

n : number of assessors

Furthermore, after all, data has been converted into qualitative data using the ideal assessment criteria guideline table in Table 1. In analyzing this data, the highest score is 5 and the lowest score is 1. The feasibility of the developed mathematical ebook can be known by calculating the average score obtained from the validation of the material expert, the media expert, and the assessment of student responses.

Table 1. Criteria for Ideal Assessment Categories

No	Score Range qualitative	Qualitative category
1	$\bar{X}_i + 1{,}80\ SB_i < \bar{X}$	Very good
2	$\bar{X}_i + 0{,}60\ SB_i < \bar{X} \leq \bar{X}_i + 1{,}80\ SB_i$	Well
3	$\bar{X}_i - 0{,}60\ SB_i < \bar{X} \leq \bar{X}_i + 0{,}60\ SB_i$	Pretty good
4	$\bar{X}_i - 1{,}80\ SB_i < \bar{X} \leq \bar{X}_i - 0{,}60\ SB_i$	Not good
5	$\bar{X} \leq \bar{X}_i - 1{,}80\ SB_i$	Very bad

Information:

$\bar{X}$: average score

$\bar{X}_i$: average ideal score

$\bar{X}_i = \frac{1}{2} \times$(ideal maximum score + ideal minimum score)

SB_i : ideal standard deviation

$SB_i = \frac{1}{6} \times$(Ideal Maximum Score - Ideal Minimum Score)

Ideal maximum score = number of criteria items × highest score

Ideal minimum score = number of criteria items × lowest score

RESULTS AND DISCUSSION

The trial data in developing a flash-based mathematical ebook for grade VIII students of the two-variable linear equation system material was obtained through the research development process with the ADDIE model. As for the data include data Analysis (Design), Design (Development), Development (Development), Implementation (Implementation), and Evaluation (Evaluation).

Based on the analysis of the data used, obtained data consisting of three assessments namely the assessment of material experts, media experts, and students.

Mathematical ebook assessment based on material aspects is done by two material experts namely Husna 'Arifah S.Sc., M.Sc. who is a mathematics lecturer at the Faculty of Mathematics and Natural Sciences, Yogyakarta State University and Rumi Hastuti, S.Pd. who is a teacher in charge of mathematics in SMP Muhammadiyah Banguntapan. The results of the calculation of the ebook quality assessment by material experts can be seen in Table 2.

Table 2. Results of the Eligibility Questionnaire Calculation for Material Expert

No	Evaluator	Score	Category
1	Husna 'Arifah S.Si., M.Sc.	61	Good
2	Rumi Hastuti, S.Pd	63	Good
Average		62	Good

Based on the table, it can be seen that the average score of the results of the assessment by material experts is 62. This shows that the developed mathematical ebook viewed from the material aspects is included in both categories. So it is feasible to use in learning.

Mathematical ebook assessment based on media aspects is done by media experts namely Faizah, S.Kom., M.Kom. who is a lecturer in the Department of Computer and Electronics Science, FMIPA UGM and Miftahurrahma Rosyda, S.Kom., M.Eng. who is a multimedia practitioner. The results of the calculation of the ebook quality assessment by media experts can be seen in Table 3.

Table 3. Results of the Eligibility Questionnaire Calculation for Media Experts

No	Evaluator	Score	The ebook quality category
1	Faizah, S.Kom., M.Kom.	85	Very good
2	Miftahurrahma Rosyda, S.Kom., M.Eng.	82	Good
Average		83,5	Good

Based on the table, it can be seen that the average score of the assessment results by media experts is 83.5. This shows that the developed mathematical ebook from the aspect of media is included in both categories. So it is feasible to use in learning.

While the students' responses to the developed mathematical ebook are known from the results of student assessments through questionnaires given during product trials in small classes in Muhammadiyah Banguntapan Middle School and Al-Qadar Banguntapan Study Guidance, as well as trial use on large classes in Muhammadiyah Middle School Banguntapan and Muhammadiyah Boarding Middle School School Pleret.

The results of the calculation of student response questionnaire in product trials in small classes can be seen in Table 4. Based on the table, it can be seen that the average score of the results of assessments by students in product trials in small classes and large classes is 33.62. This shows that the developed mathematical ebook seen from the response of students included in the category is very good. So it is feasible to use in learning.

Table 4. Results of Calculation of Questionnaire Student Response on Trial Products in Small Classes and Large Classes

No	Activity	Score	Category
1	Trial small classes	33,55	Good
2	Trial big classes	33.69	Very good
Average		**33,62**	Very good

CONCLUSION

Based on the results of research on the development of flash-based mathematical ebook development for grade VIII students of the two-variable linear equation system material, the following conclusions are obtained:

1. Designing and producing flash-based mathematical ebooks for grade VIII students of the two-variable linear equation system using Macromedia flash 8 software developed with the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation). Flash-based math ebooks can be accessed online or offline. Ebooks can be accessed online through the page http://edu.zunto.com using a browser that has a flash plug-in installed, whereas when accessed offline by copying ebook files from the Ebook CD (Compact Disc) to drive D (Local Disk D) on a computer device.
2. The feasibility of a flash-based mathematical ebook for grade VIII students of the two-variable linear equation system based on assessment in terms of material aspects, media aspects, and student responses are as follows:
   a. Based on the assessment in terms of material aspects, the ebook is in the Good category with an average score of 62.00 from an ideal maximum score of 75.
   b. Based on the assessment in terms of media aspects, the ebook is classified in the Good category with an average score of 83.50 from an ideal maximum score of 100.
   c. Based on the assessment of student responses, the ebook is in the Very Good category with an average score of 33.62 from an ideal maximum score of 40

Based on these assessments, it can be concluded that in general a flash-based mathematics ebook for students of class VIII material systems of two-variable linear equations developed are included in either category. Thus the flash-based mathematics ebook for students of class VIII material systems of linear equations are two variables worth using in learning mathematics

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